

# Miniature Ceramic Fixed Attenuator

50Ω 1W 15dB DC to 7000 MHz

PAT-15+



Generic photo used for illustration purposes only

CASE STYLE: AF320

+RoHS Compliant

The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications



Available Tape and Reel  
at no extra cost

Reel Size Devices/Reel  
7" 1000

## Maximum Ratings

|                                                                 |                |
|-----------------------------------------------------------------|----------------|
| Operating Temperature                                           | -55°C to 100°C |
| Storage Temperature                                             | -55°C to 100°C |
| Permanent damage may occur if any of these limits are exceeded. |                |

## Pin Connections

|        |     |
|--------|-----|
| INPUT  | 1   |
| OUTPUT | 3   |
| GROUND | 2,4 |

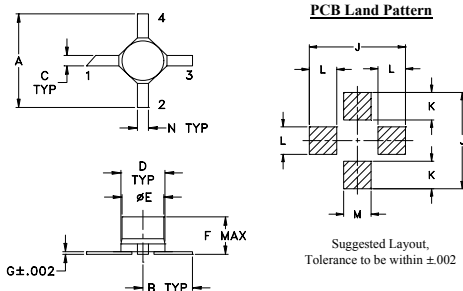
## Features

- wideband, DC to 7000 MHz
- excellent VSWR, through entire band
- miniature size
- aqueous washable

## Applications

- power leveling
- impedance match improvement

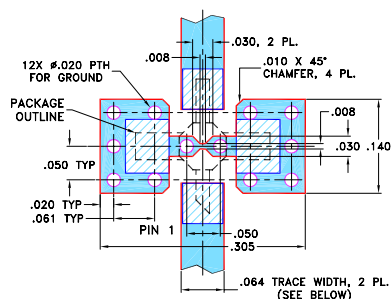
## Outline Drawing



## Outline Dimensions (inch/mm)

| A    | B    | C    | D    | E    | F    | G     |
|------|------|------|------|------|------|-------|
| .200 | .100 | .020 | .070 | .068 | .057 | .005  |
| 5.08 | 2.54 | 0.51 | 1.78 | 1.73 | 1.45 | 0.13  |
| H    | J    | K    | L    | M    | N    | wt    |
| --   | .230 | .065 | .060 | .080 | .040 | grams |
| --   | 5.84 | 1.65 | 1.52 | 2.03 | 1.02 | 0.04  |

## Demo Board MCL P/N: TB-319 Suggested PCB Layout (PL-208)



### NOTES:

1. TRACE WIDTH IS SHOWN FOR ROGERS RO4350B WITH DIELECTRIC THICKNESS .030" ± .002"; COPPER: 1/2 OZ. EACH SIDE. FOR OTHER MATERIALS TRACE WIDTH MAY NEED TO BE MODIFIED.
  2. BOTTOM SIDE OF THE PCB IS CONTINUOUS GROUND PLANE.
- DENOTES PCB COPPER LAYOUT WITH SMOBC (SOLDER MASK OVER BARE COPPER)
- DENOTES COPPER LAND PATTERN FREE OF SOLDER MASK

### Notes

- A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
- B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
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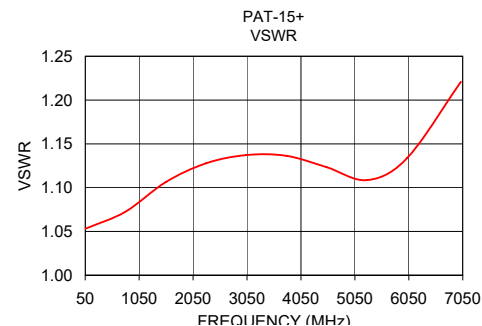
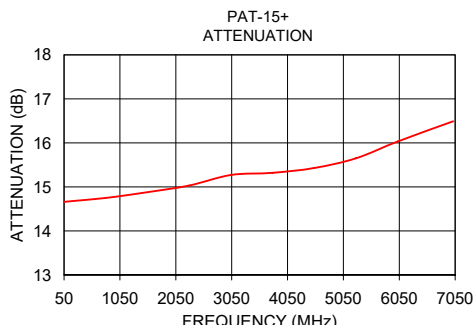
## Electrical Specifications at 25°C

| FREQ.<br>RANGE<br>(MHz) | ATTENUATION<br>(dB)<br>Flatness, Max. |      |             |               | VSWR<br>(:1)<br>Max.     |             |               | MAX.<br>INPUT<br>POWER<br>(W) |
|-------------------------|---------------------------------------|------|-------------|---------------|--------------------------|-------------|---------------|-------------------------------|
|                         | f <sub>L</sub> -f <sub>U</sub>        | Nom. | DC-1<br>GHz | DC-2.5<br>GHz | DC-f <sub>U</sub><br>GHz | DC-1<br>GHz | DC-2.5<br>GHz |                               |
| DC-7000                 | 15±0.6                                | 0.5  | 0.7         | 2.4           | 1.3                      | 1.4         | 1.5           | 1                             |

1. RF power at 25°C case temperature: 1 Watt. Derate linearly to 0.1 Watt at 100°C.

## Typical Performance Data

| Frequency<br>(MHz) | Attenuation<br>(dB) | VSWR<br>(:1) |
|--------------------|---------------------|--------------|
| 50.00              | 14.66               | 1.05         |
| 796.25             | 14.75               | 1.07         |
| 1542.50            | 14.88               | 1.11         |
| 2288.75            | 15.03               | 1.13         |
| 3035.00            | 15.27               | 1.14         |
| 3781.25            | 15.32               | 1.14         |
| 4527.50            | 15.43               | 1.12         |
| 5273.75            | 15.65               | 1.11         |
| 6020.00            | 16.03               | 1.13         |
| 7015.00            | 16.49               | 1.22         |



REV. H  
M151107  
PAT-15+  
200406

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*Typical Performance Data*

| FREQUENCY<br>(MHz) | ATTENUATION<br>(dB) | RETURN LOSS<br>(dB) |
|--------------------|---------------------|---------------------|
| 50.00              | 14.66               | 31.77               |
| 796.25             | 14.75               | 29.12               |
| 1542.50            | 14.88               | 25.94               |
| 2288.75            | 15.03               | 24.43               |
| 3035.00            | 15.27               | 23.85               |
| 3781.25            | 15.32               | 23.90               |
| 4527.50            | 15.43               | 24.72               |
| 5273.75            | 15.65               | 25.76               |
| 6020.00            | 16.03               | 24.05               |
| 7015.00            | 16.49               | 20.05               |

REV. X1  
PAT-15+  
061108  
Page 1 of 1



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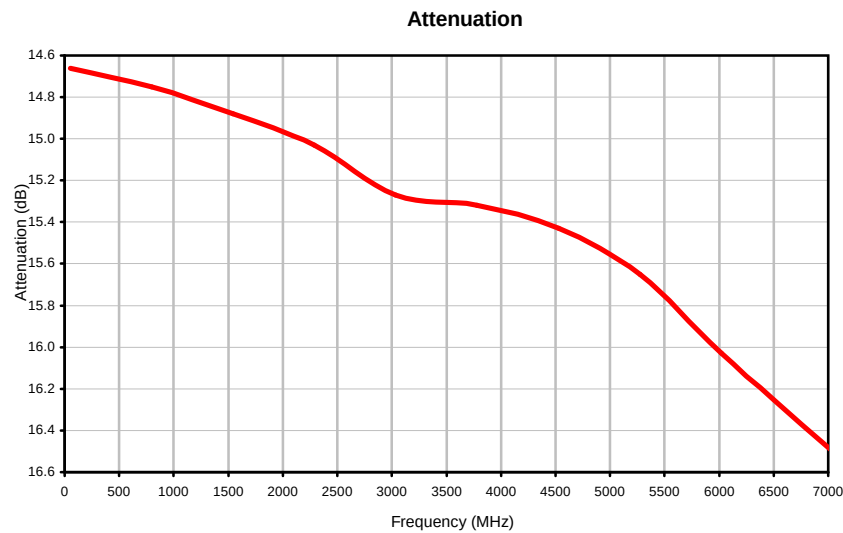


Patent Pending

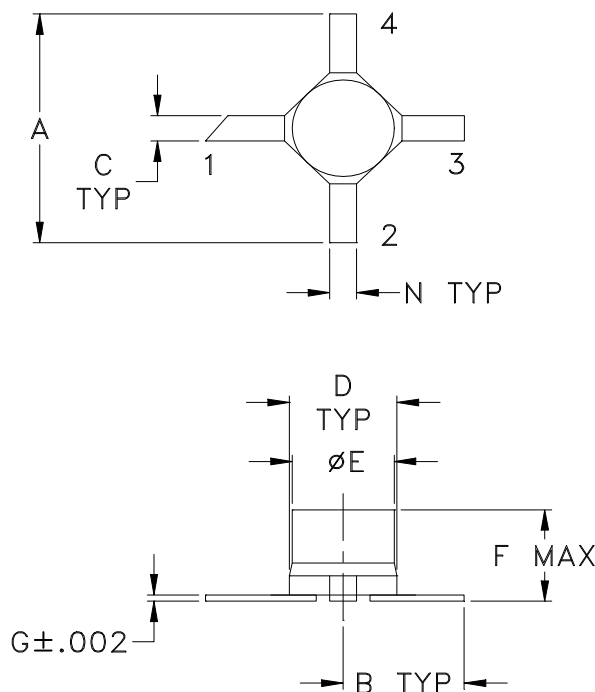
The Design Engineers Search Engine finds the model you need, Instantly • For detailed performance specs & shopping online see



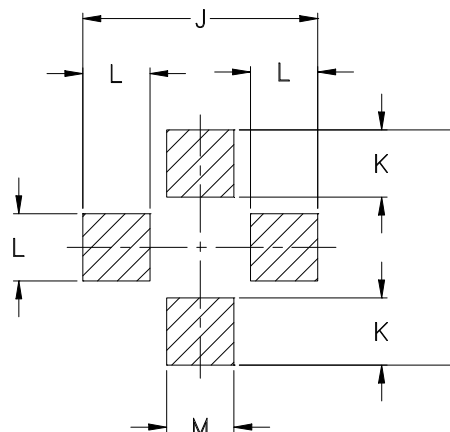
## Typical Performance Curves



### Outline Dimensions



### PCB Land Pattern



Suggested Layout,  
Tolerance to be within  $\pm .002$

| CASE # | A              | B              | C              | D              | E              | F              | G              | H | J              | K              | L              | M              | N              | WT. GRAM |
|--------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|---|----------------|----------------|----------------|----------------|----------------|----------|
| AF320  | .200<br>(5.08) | .100<br>(2.54) | .020<br>(0.51) | .070<br>(1.78) | .068<br>(1.73) | .057<br>(1.45) | .005<br>(0.13) | - | .230<br>(5.84) | .065<br>(1.65) | .060<br>(1.52) | .080<br>(2.03) | .040<br>(1.02) | .04      |

Dimensions are in inches (mm). Tolerances: 2Pl.  $\pm .03$ ; 3Pl.  $\pm .015$

#### Notes:

- Case material: Ceramic.
- Termination material:  
Nickel-Iron alloy 42.
- Termination finish:  
For RoHS Case Styles: Tin-Silver alloy plate over Nickel barrier or Matte-Tin. (See Data Sheet)  
For RoHS-5 Case Styles: Tin-Lead plate.
- Termination (1):  
May have diagonal cut. Input and output interchangeable for PAT models only.
- Special Tolerances: Termination width  $\pm .005$  inch, termination thickness  $\pm .002$  inch, cap diameter  $\pm .005$  inch.



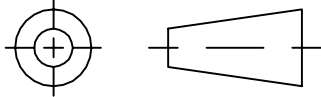
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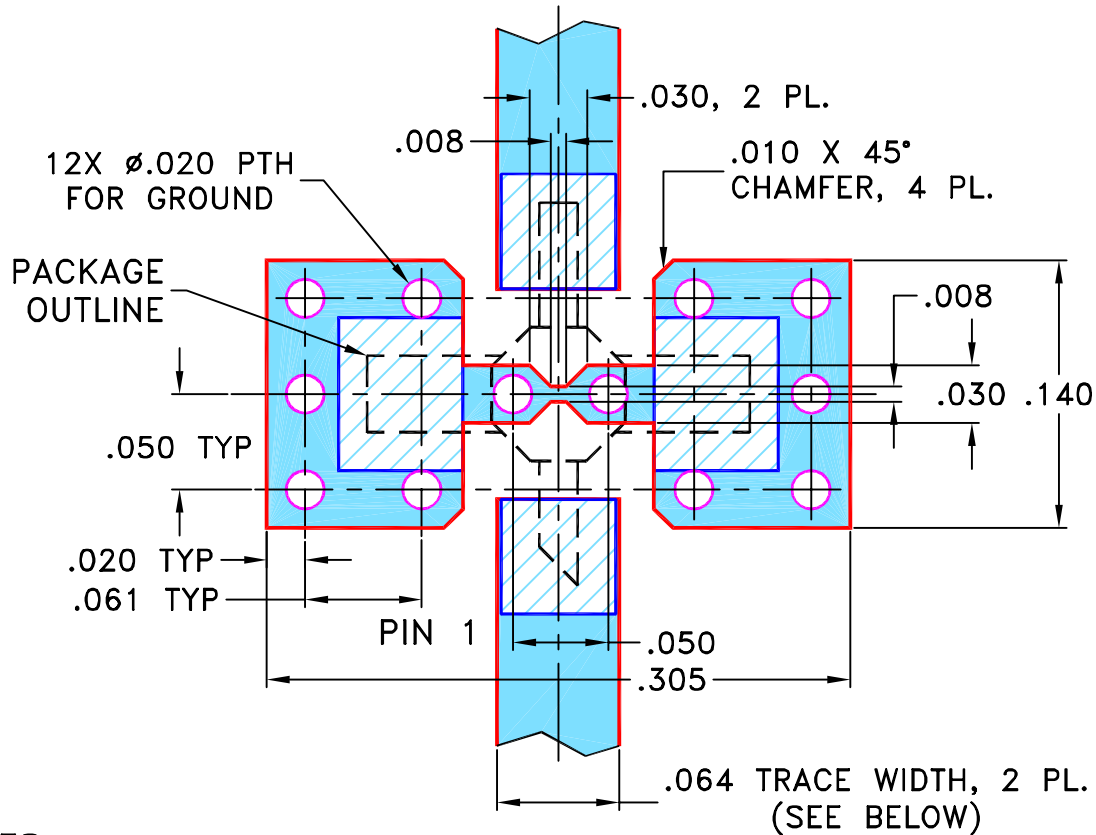
## THIRD ANGLE PROJECTION



## REVISIONS

| REV | ECN No. | DESCRIPTION           | DATE     | DR  | AUTH |
|-----|---------|-----------------------|----------|-----|------|
| OR  | M100749 | NEW RELEASE           | 09/19/05 | MMG | MM   |
| A   | M102713 | ADDED "...WITH SMOBC" | 01/12/06 | GT  | IL   |
|     |         |                       |          |     |      |
|     |         |                       |          |     |      |

SUGGESTED MOUNTING CONFIGURATION FOR  
AF320 CASE STYLES, "hl" PIN CONNECTION

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UNLESS OTHERWISE SPECIFIED

INITIALS

DATE

DIMENSIONS ARE IN INCHES

TOLERANCES ON:

2 PL DECIMALS  $\pm$ 3 PL DECIMALS  $\pm$  .005ANGLES  $\pm$  1°FRACTIONS  $\pm$ 

DRAWN

MMG

09/12/05

CHECKED

AV

09/16/05

APPROVED

MM

09/19/05



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PL, hl, AF320, PAT, TB-319

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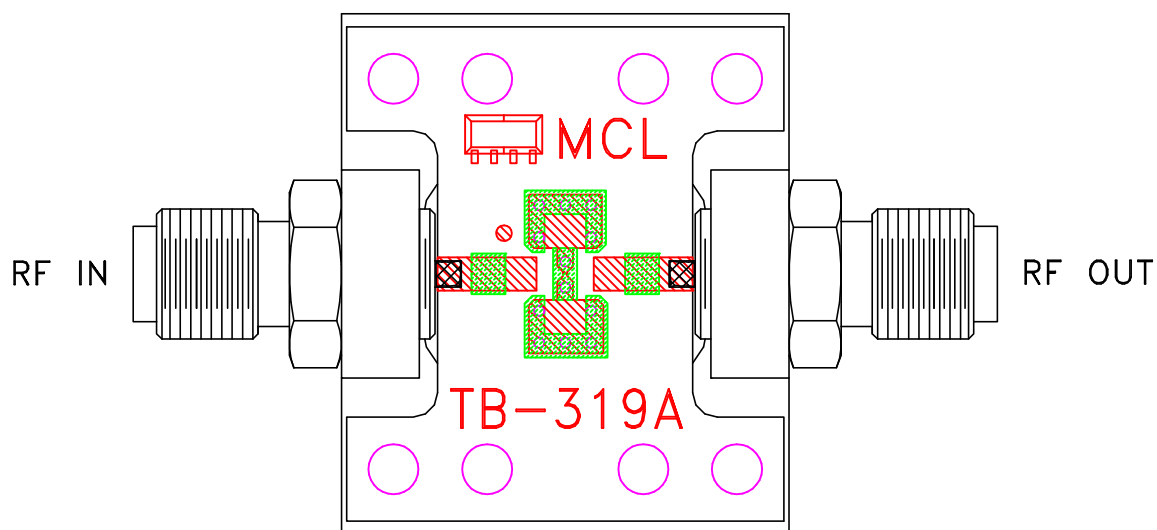
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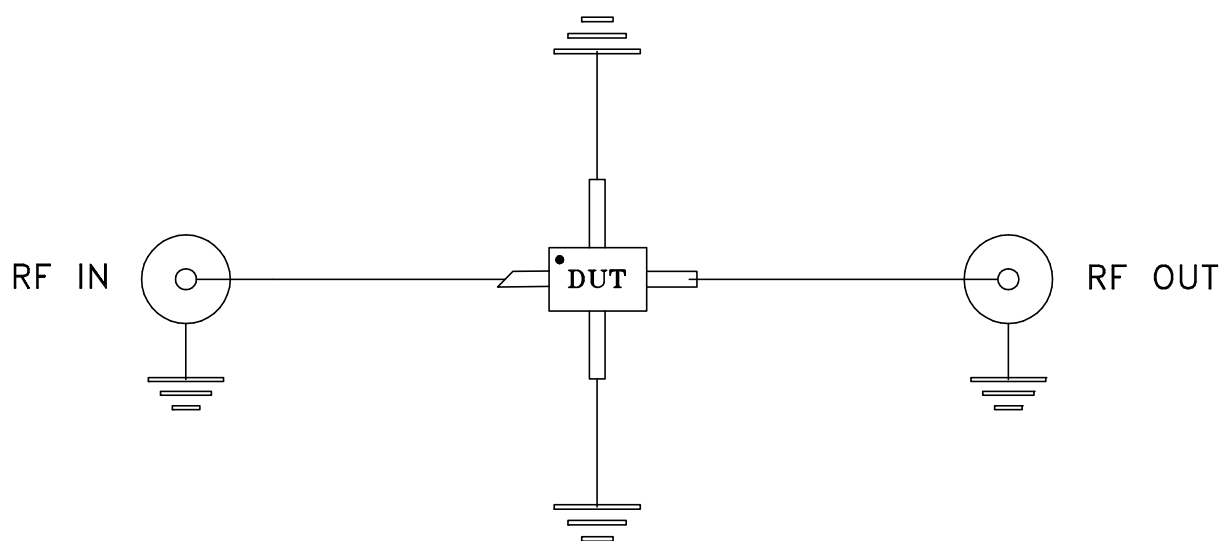
SCALE: 10:1

SHEET: 1 OF 1

# Evaluation Board and Circuit



TB-319



Schematic Diagram

## Notes:

1. SMA Female connectors.
2. PCB Material: Rogers R04350 or equivalent,  
Dielectric Constant=3.5, Thickness=.030 inch.

 **Mini-Circuits®**



All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

| Specification                  | Test/Inspection Condition                                        | Reference/Spec                                                  |
|--------------------------------|------------------------------------------------------------------|-----------------------------------------------------------------|
| Operating Temperature          | -54° to 100°C<br>Ambient Environment                             | Individual Model Data Sheet                                     |
| Storage Temperature            | -65° to 150° C<br>Ambient Environment                            | Individual Model Data Sheet                                     |
| Autoclave                      | 15 psig, 100% RH, 121°C, 96 hours                                | JESD22-A102-C, Condition C                                      |
| Thermal Shock                  | -55° to 100°C, 100 cycles                                        | MIL-STD-202, Method 107, Condition A-3, except +100°C           |
| Mechanical Shock               | 1.5Kg, 0.5 ms, 5 shock pulses, Y1 direction only                 | MIL-STD-883, Method 2002, Condition B, except Y1 direction only |
| Vibration (Variable Frequency) | 50g peak                                                         | MIL-STD-883, Method 2007, Condition B                           |
| Constant Acceleration          | Y1 plane only, 5 Kg                                              | MIL-STD-883, Method 2001, Condition A, except Y1 plane only     |
| Seal                           | Perfluorocarbon gross leak                                       | MIL-STD-883, Method 1014, Condition C                           |
| HAST                           | 130°C, 85% RH, 96 hours                                          | JESD22-A110                                                     |
| Solderability                  | 10X Magnification                                                | J-STD-002, Para 4.2.5, Test S, 95% Coverage                     |
| Solder Reflow Heat             | Sn-Pb Eutetic Process: 240°C peak<br>Pb-Free Process: 260°C peak | J-STD-020, Table 4-1, 4-2 and 5-2; Figure 5-1                   |



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| Specification                  | Test/Inspection Condition                                                                                                                                       | Reference/Spec          |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| Moisture Sensitivity: Level 1  | Bake at 125°C for 24 hours<br>Soak at 85°C/85% RH for 168 hours, Reflow 3 cycles at 260°C peak                                                                  | J-STD-020               |
| Marking Resistance to Solvents | Isopropyl alcohol + mineral spirits at 25°C; terpene defluxer at 25°C;<br>distilled water + proylene glycol monomethyl ether + monoethanolamine at 63°C to 70°C | MIL-STD-202, Method 215 |